ORIGINAL RESEARCH PAPER

Anaesthesiology

PERFUSION INDEX FROM UPPER LIMB AS A TOOL IN THE PREDICTION OF SPINAL ANAESTHESIA INDUCED HYPOTENSION DURING CAESAREAN DELIVERY

KEY WORDS: Perfusion Index, Hypotension and Spinal Anaesthesia.

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ABSTRACT

Background: Hypotension following spinal anaesthesia during elective caesarean commonly seen either due to decreased in vascular tone or decreased cardiac output because of blood pooling. Peripheral perfusion index (PI) being a non-invasive measure of real time change in peripheral blood flow can be a dynamic measure in prediction of hypotension. **Methodology:** This is a prospective study done in Assam Medical college and hospital recruiting 100 parturient based on inclusion and exclusion criteria. They were divided into two groups with 50 parturient in each group with baseline PI>3.5 and <3.5 respectively. The statistical analysis was done using SPSS. Statistical significance was fixed at 5% level (p value <0.05). **Results:** Majority of parturient were less than 25years of age, less than 160cms in height and weight less than 65kgs in both groups. No statistical significance observed between the study groups in terms of duration of surgery. The incidences of Hypotension in Group I (PI > 3.5) was 54% compared to Group II (PI ≤ 3.5) which was 13% and was highly statistically significant (p=0.001). **Conclusion:** Parturient with a baseline PI >3.5 were at higher risk of developing hypotension compared to those with a baseline PI ≤ 3.5 following spinal anaesthesia. Thus, preoperative baseline PI can be used as a predictive tool for hypotension.

INTRODUCTION:

Hypotension after Spinal anaesthesia for elective Caesarean section is that the results of combination of decreased vascular resistance because of sympathetic blockade[1] and decreased cardiac output because of blood pooling in blocked areas of the body[2-4]. Although baseline volume status is thought to affect the degree of hypotension [5], baseline peripheral vascular tone may have influence.

PI is often accustomed to assess peripheral perfusion dynamics because of changes in peripheral vascular tone[6-10] and also the changes within the sympathetic nervous tone affecting the smooth muscle tone, results in altering the levels of perfusion. Non-invasive blood pressure (NIBP) measurement is employed as a standard method of monitoring intraoperative and postoperative hemodynamics. But the limitation is that, beat to beat variation cannot be measured by this method.

As the use of perfusion index (PI) which is a non-invasive measure of real time changes in peripheral blood flow and may be a dynamic measure of vascular responsiveness. Use of Baseline perfusion index in prediction of hypotension will definitely create an innovative approach to the patient's safety.[11]

AIM:

To assess the use of the baseline perfusion index from the upper limb in predicting the incidences of Hypotension after spinal anaesthesia during caesarean delivery.

METHODOLOGY:

Study setting:

Prospective Study conducted in Department of Anaesthesiology, Assam medical College and Hospital, Dibrugarh which is a tertiary care centre. The study was done for one year.

Sample Size:

Based on the S.Toyoma et al [12] study, considering a 95% confidence interval with a relative error of 10%, the sample size for the present study is calculated and rounded off to be 100.

Inclusion Criteria:

- Age range: 18-35 years
- American society of Anaesthesiologists physical status (ASA) I and II
- Baseline Systolic blood pressure (SBP) 100-140 mm Hg and Diastolic blood pressure (DBP) 70-89 mm Hg.

Exclusion Criteria:

- Patient refusal
- Hypertensive disorders of pregnancy
- Antepartum haemorrhage
- Pregnant women with any comorbidities
- Contraindications to regional anaesthesia

Institutional Ethics committee clearance was taken prior to conduction of the study. After explaining the procedure and obtaining the written informed consent from each patient the study was conducted. Anticipating equal distribution of baseline PI on either side of cut-off point of 3.5 suggested in a study by S. Toyoma et al.[12], parturients were divided into two groups with 50 parturients in each group as follows, Group I - parturient with Baseline PI > 3.5 and Group II- parturient with Baseline PI ≤ 3.5.

Pre-operative check-up was done thoroughly which includes general, systemic examinations and relevant essential laboratory investigations.

The patients were kept Nil per orally for minimum 8 hours. Parameters like Electrocardiography (ECG), Baseline Heart rate (HR), Non-invasive blood pressure (NIBP) and pulse oximetry (SpO2) were recorded in the operation theatre. The perfusion index is measured in the supine position using a MASIMO pulse oximeter probe, which is attached to the left index finger of all parturients to ensure uniformity in measured PI values.

Spinal anaesthesia is performed using Quincke's 25-gauge spinal needle in the left lateral decubitus position with 12 mg of injection bupivacaine 0.5% (hyperbaric) at the L3–L4 interspace. The parturient is returned to the supine position with a left lateral tilt of 15° to facilitate left uterine displacement. The level of sensory block is checked 5 min after the spinal injection. Maximum cephalic spread is checked 20 min after spinal blockade. NIBP, heart rate (HR), respiratory rate (RR) and SpO2 are recorded at 1 minute intervals after the spinal anaesthesia up to delivery of the baby and then at 3 minutes intervals till the end of surgery. Parturients requiring additional surgical interventions were excluded from the study.

Statistical Analysis:

The statistical analysis of data was performed using the computer program, SPSS and Microsoft Excel 2010. Results on continuous measurements are presented as mean ± standard deviation and are compared using Student's t-test. Discrete data are expressed as number (%) and are analyzed using Chi square test and Fischer's exact test (where the cell counts were <5 or 0). For all analyses, the statistical significance was fixed at 5% level (p value <0.05).

RESULTS:

Table 1: Demographic characteristics of the study groups

Demographic Variables	Group I (PI > 3.5) (N)	Group II (PI <3.5) (N)	p value
Age <25 years >25 years	 26 (52%) 24(48%)	 28(56%) 22(44%)	0.817
Height (in Cm) <160 cm >160 cm	 35 (70%) 15 (30%)	 37 (74%) 13(26%)	0.632
Weight (in Kg) <65 Kg >65 Kg	 33 (66%) 17 (34%)	 37(74%) 13(26%)	0.668

In our study majority of the study parturients were less than 25 years of age [Group I – 26(52%), Group II – 28 (56%)]. Most of the study parturients were less than 160cm [Group I-35 (70%), Group II-37 (74%)]. Most of the study parturient were less than 65 Kgs [Group I-33 (66%), Group II-37 (74%)].

Table- 2: Comparison of Duration of Surgery between the study groups

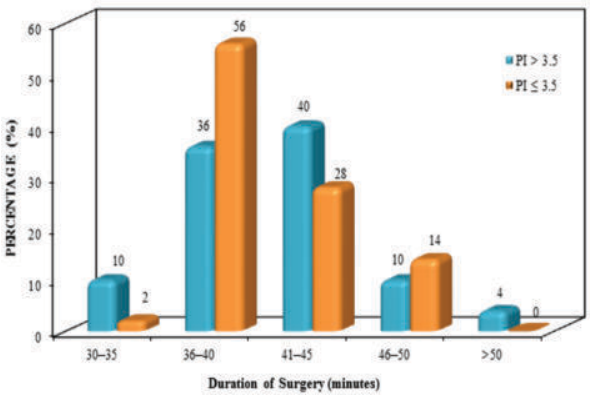
Duration of Surgery (minutes)	Group I (PI > 3.5)		Group II (PI ≤ 3.5)		P value
	N	%	n	%	0.083
30–35	5	10.00	1	2.00	
36–40	18	36.00	28	56.00	
41–45	20	40.00	14	28.00	
46–50	5	10.00	7	14.00	
>50	2	4.00	0	0.00	
TOTAL	50	100.00	50	100.00	
*Fisher's Exact Test; the p-value is not significant at 5% level of significance					

In our study, under group I (PI >3.5), 20 (40%) parturients had surgery duration of 41-45 minutes and in group II (PI≤ 3.5), 28(56%) parturients had surgery duration of 36-40 minutes and their differences were not statistically significant ***(p=0.083).*** The Mean Arterial Pressure (MAP) between the groups in our study from baseline to 9 minutes before delivery of the baby showed no statistical significance ***(p>0.05).***

Table–3: Mean Arterial Pressure (MAP) Before Delivery of the Baby between the groups

Time Interval (minute)	Group I (PI > 3.5)		Group II (PI ≤ 3.5)		P value
	Mean	± S.D.	Mean	±S.D.	
Baseline	94.33	31.23	85.20	28.48	0.112
1	90.94	30.04	81.36	26.89	0.081
2	90.47	29.56	81.09	26.43	0.082
3	89.18	29.13	79.25	26.11	0.062
4	89.71	29.49	79.68	26.49	0.063
5	89.16	29.24	79.93	26.32	0.085
6	87.94	29.36	77.62	25.22	0.051
7	87.23	28.80	76.95	25.84	0.051
8	77.76	38.97	70.88	34.10	0.327
9	62.93	46.85	65.79	38.17	0.726
*Student's t-Test; the p-value is not significant at 5% level of significance					

Figure-1. Showing Duration of Surgery



Table–4: Mean Arterial Pressure (MAP) After Delivery of the Baby between the groups

Time Interval (minute)	Group I (PI > 3.5)		Group II (PI ≤ 3.5)		p value
	Mean	±S.D.	Mean	±S.D.	
3	86.01	27.96	79.35	25.81	0.197
6	86.21	28.08	77.77	25.53	0.102
9	86.64	28.27	75.42	24.72	*0.029
12	85.34	27.62	78.36	25.58	0.172
15	87.55	28.47	76.94	25.41	*0.042
18	89.37	28.87	79.49	25.98	0.062
21	90.30	29.29	79.29	26.30	*0.040
24	91.99	29.62	80.76	26.42	0.038
27	90.21	29.31	80.71	26.70	0.079
30	92.13	30.10	82.46	26.85	0.078
33	71.89	48.75	64.91	42.17	0.424
36	26.00	44.92	23.97	40.14	0.803
39	8.38	26.89	9.50	27.54	0.829
42	3.35	17.41	1.44		
45	3.52	18.26			
*Student's t-Test; the p-value is not significant at 5% level of significance					

Table-4 shows the MAP after delivery of the baby at 3 minutes to 45 minutes with an interval of 3 minutes. During **9th, 15th and 21st minutes,** there was statistically significant fall in MAP ***(p<0.05)*** was found.

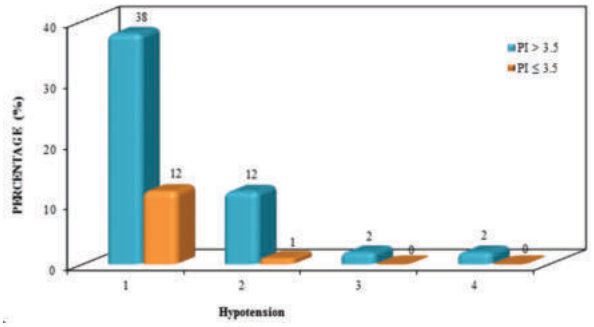
Table- 3: Showing incidences of Hypotension

Hypotension	Group I (PI > 3.5)		Group II (PI ≤ 3.5)		P value
	N	%	N	%	
1	19	38.00	9	12.00	0.001*
2	6	12.00	1	1.00	
3	1	2.00	0	0.00	
4	1	2.00	0	0.00	
*Fisher Exact Test Test; the p-value is significant at 5% level of significance					

In our study, total incidence of hypotension in Group I was 54% (27/50) when compared to Group II of 26% (13/50). Incidence of hypotension is doubled in group I (PI > 3.5).

Thirty-seven parturients had no episode, 9 parturients had one episode, and only 1 parturient had two episodes of hypotension in group II (PI ≤3.5) with highly statistical significance of ***p<0.001***.

Figure-2. Showing incidences of Hypotension



DISCUSSION:

In our Study, differences in demographic variables such as age, height, weight between the groups had no effect over predicting the incidences of hypotension during spinal anaesthesia for caesarean delivery. From our study findings, age, height, weight cannot be used as predictors of spinal anaesthesia induced hypotension during caesarean delivery which were similar to the independent studies conducted by ***Toyama et al.***[12] ***and Dugappa et al.***[13]

In our Study, there is no significant difference in surgery duration between groups (p=0.416), with a mean duration of 41.26 ± 4.04 min in Group I (PI >3.5) and a mean duration of 40.64 ± 3.53 min in Group II (PI ≤ 3.5). The findings of our study are statistically similar when compared to a study conducted by ***Dugappa et al***[13]

Perfusion index has been used in the study by ***Mowafi et al.***[6] to detect intravascular injection of the epinephrine-containing epidural test dose, hence its reliability to detect vasoconstriction has been demonstrated successfully. ***Ginosar et al.***[7] demonstrated that an increase in PI following epidural anaesthesia is a clear and reliable indicator of sympathectomy. In a study by ***Toyama et al.***[12]***,*** they found a sensitivity and specificity of 81% and 86%, respectively, for baseline PI with a cut-off of 3.5 to predict hypotension.

Hypotension following spinal anaesthesia is mainly a result of decreased systemic vascular resistance due to blockade of sympathetic fibres[22]. Parturient with a high baseline perfusion index are expected to have lower peripheral vascular tone and, hence, are at higher risk of developing hypotension following spinal anaesthesia. In an independent study conducted by ***Dugappa et al***[13], the incidence of hypotension in Group I with PI ≤ 3.5 was 10.5% (6/57) compared to Group II with PI > 3.5 which was 71.42% (45/63) which was clinically and statistically highly significant (***p<0.001***). In a study conducted by ***Toyama et al.***[12] The incidence of hypotension in parturients with a cut-off of 3.5 was observed to be 82% in parturients with PI >3.5 and 25% in parturients with PI < 3.5, which is highly significant***(p<0.001)***.In our study the incidences of Hypotension in Group I (PI > 3.5) was 54% when compared to Group II (PI ≤ 3.5) was 13% which is statistically highly significant (***p=0.001***) and statistically similar to the above mentioned studies.

CONCLUSION:

The baseline Perfusion Index (PI) measured preoperatively is associated with the degree of decrease in arterial pressure following Spinal anaesthesia during Caesarean delivery which can also be used as a predictive tool. We conclude that parturient with a baseline PI >3.5 are at a higher risk of developing hypotension after spinal anaesthesia when compared to those with a baseline PI ≤ 3.5. The baseline PI cut-off point of 3.5 can be used to identify parturient at high risk for such hypotension.

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